

Top coats for controlling vertical & lateral orientations of block copolymer microdomains*

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Achieving sub-10 nm high-aspect-ratio patterns from diblock copolymer self-assembly requires both a high interaction parameter (χ , determined by the incompatibility between the two blocks) and a perpendicular orientation of microdomains. We firstly realize a fully perpendicular orientation of a high-block copolymer, poly(styrene-block-dimethylsiloxane) (PS-*b*-PDMS), using partially hydrolyzed polyvinyl alcohol (PVA) top coats with a solvent annealing process, despite the large surface energy differences between PS and PDMS. The PVA top coat on the block copolymer films under a solvent vapor atmosphere not only significantly reduces the interfacial energy difference between two blocks at the top surface but also provides sufficient solvent concentration gradient in the through-thickness direction and appropriate solvent evaporation rates within the film to promote a perpendicular microdomain orientation. We also introduce top coats of polyvinyl acetate (PVAc) on PS-*b*-PDMS film to form the perpendicular orientation of BCP microdomains and induce dewetting process for the laterally aligned BCP patterns during the solvent annealing.